

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER- IV (New) EXAMINATION – WINTER 2019****Subject Code: 2140403****Date: 14/12/2019****Subject Name: Principles of Process Engineering-I****Time: 10:30 AM TO 01:00 PM****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

		MARKS
Q.1	Short Questions	14
	1 What is Conduction?	01
	2 What do you mean by heat transfer?	01
	3 Write the units of thermal conductivity	01
	4 Write value of Stefan-Boltzmann Constant with proper units.	01
	5 What is monochromatic Emissivity?	01
	6 Define: opaque body and white body	02
	7 State Kirchhoff's Law of Heat Radiation.	01
	8 What is pump?	01
	9 Value of coefficient of discharge for venturi meter is _____	01
	10 Define: a) Ideal Fluid b) Real Fluid c) Bingham Plastic fluid d) inviscid	04
Q.2	(a) Differentiate between Natural Convection and Forced Convection with suitable examples.	03
	(b) Derive the expression for critical radius of insulation in case of cylinder.	04
	(c) Calculate the critical radius of insulation for asbestos with $k=0.17 \text{ W/m}^2\text{K}$ surrounding a pipe and exposed to room air at 20°C with $h=3 \text{ W/m}^2\text{K}$. Calculate the heat loss from a 200°C , 50 mm diameter pipe when covered with the critical radius of insulation and without insulation. Would any fiber glass insulation having a thermal conductivity of 0.04 W/m.K cause decrease in heat transfer?	07
	OR	
	(c) Explain Fourier's law for heat conduction in detail. Also apply it for the case of plane wall and composite wall with neat sketches.	07
Q.3	(a) Write note on double pipe heat exchanger with neat diagram.	03
	(b) Explain advantages and disadvantages of single pass and multi pass heat exchangers.	04
	(c) Derive equation for LMTD in case of heat exchanger.	07
	OR	
Q.3	(a) Give the detailed classification of fluids.	03
	(b) Discuss in brief the three modes of Heat transfer.	04
	(c) Explain principle of hydrostatic equilibrium and derive expression for it.	07
Q.4	(a) Explain concept of black body in brief.	03
	(b) Explain different types of flow pattern in heat exchanger.	04
	(c) Derive Bernoulli's equation with appropriate assumptions and write it for pump.	07

- Q.4** (a) Explain wave theory of radiation. **03**
(b) Explain friction factor and show that $f = 16/NRe$ for laminar flow. **04**
(c) Derive Hagen-Poiseuille equation for pressure drop and give its applications. **07**

- Q.5** (a) Give the detailed classification of pumps. **03**
(b) Explain cavitations in pump. **04**
(c) Calculate the power to pump a liquid at the rate of 1.5 kg/s from a ground level tank at atmospheric pressure through a 50mm ID steel pipe to an overhead tank 3m above at 2 kg/cm² pressure. The distance between two tanks is 500m. Efficiency of the pump is 70%. The density and viscosity of the liquid is 1500kg/m³ and 20 cp respectively. Friction factor $f = 16/NRe$ **07**

OR

- Q.5** (a) Explain concept of drag force **03**
(b) Explain concept of fluidization and give types of fluidization. **04**
(c) Explain construction and working of venturi meter and also derive flow equation for the same with neat sketch. **07**

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